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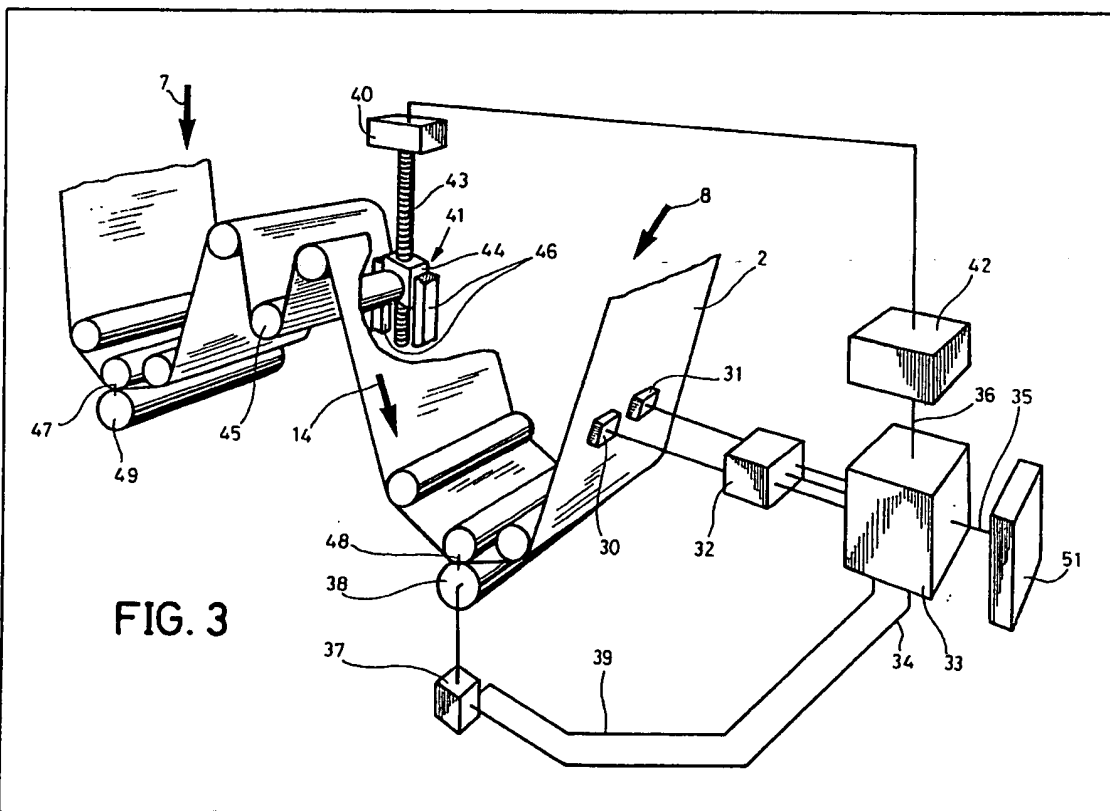
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(54) Method and device identifying the registering marks in order to position a reading aperture

(57) A device for identifying registration marks includes two reading heads 30 and 31 connected by an amplifier 32 to an analyzing device 33 which processes the information read on the web 2 running

over an engraved cylinder 38. An angular encoder 37 of the cylinder calculates the angular position of the engraved cylinder 38 while it rotates, and transmits it to the analyzing device 33, which memorises the received information from cycle to cycle of the cylinder 38. Said device 33 also sends out a signal 36 in order to control the idler roller 41 creating a positive or negative elongation of the web 2 between two points 47, 48 on it. The change in length, thus achieved, allows the identification of the registering marks, by comparing the different registering mark reading results before and after the change in length.



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FIG. 1

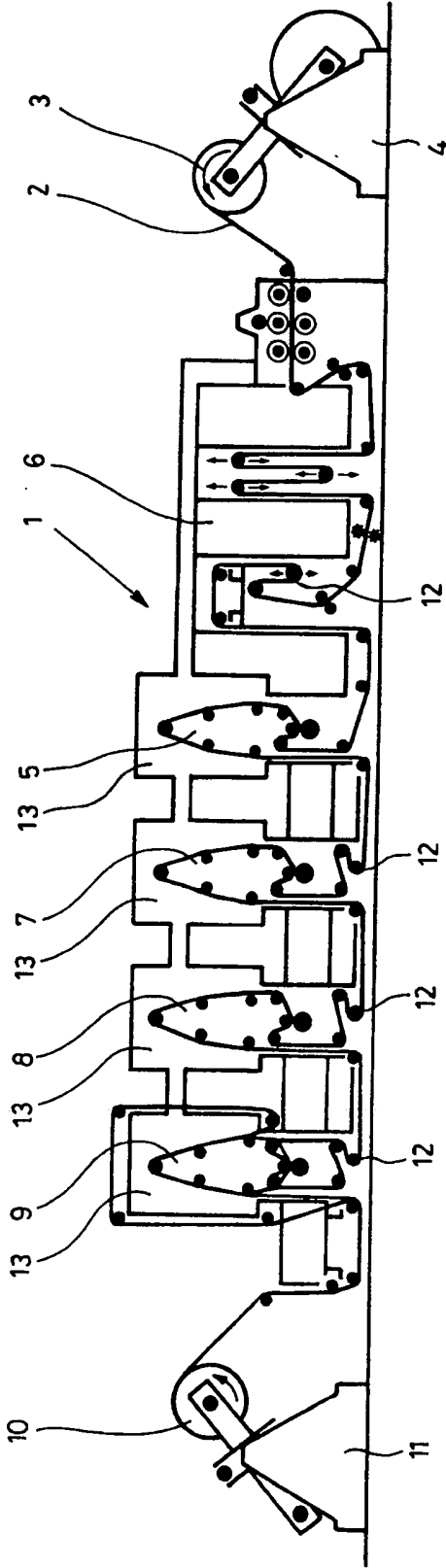


FIG. 2a

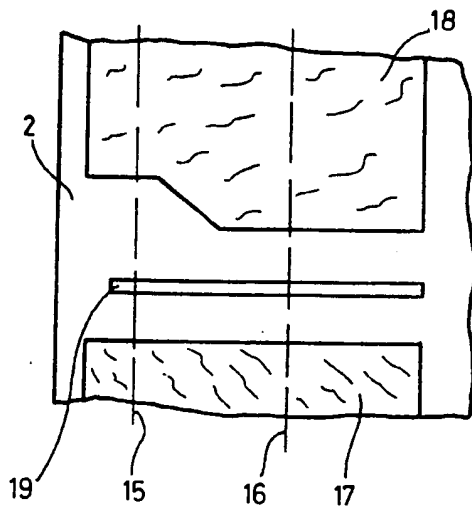
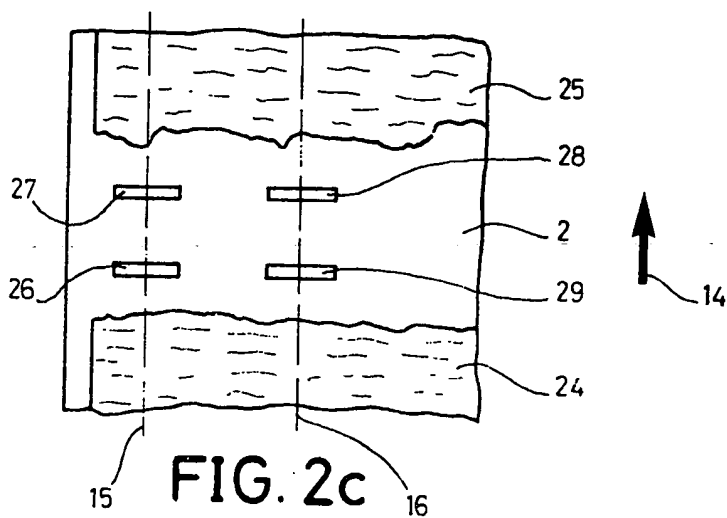
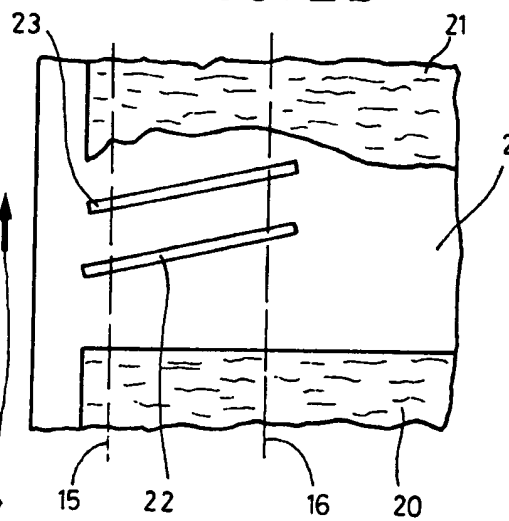


FIG. 2b



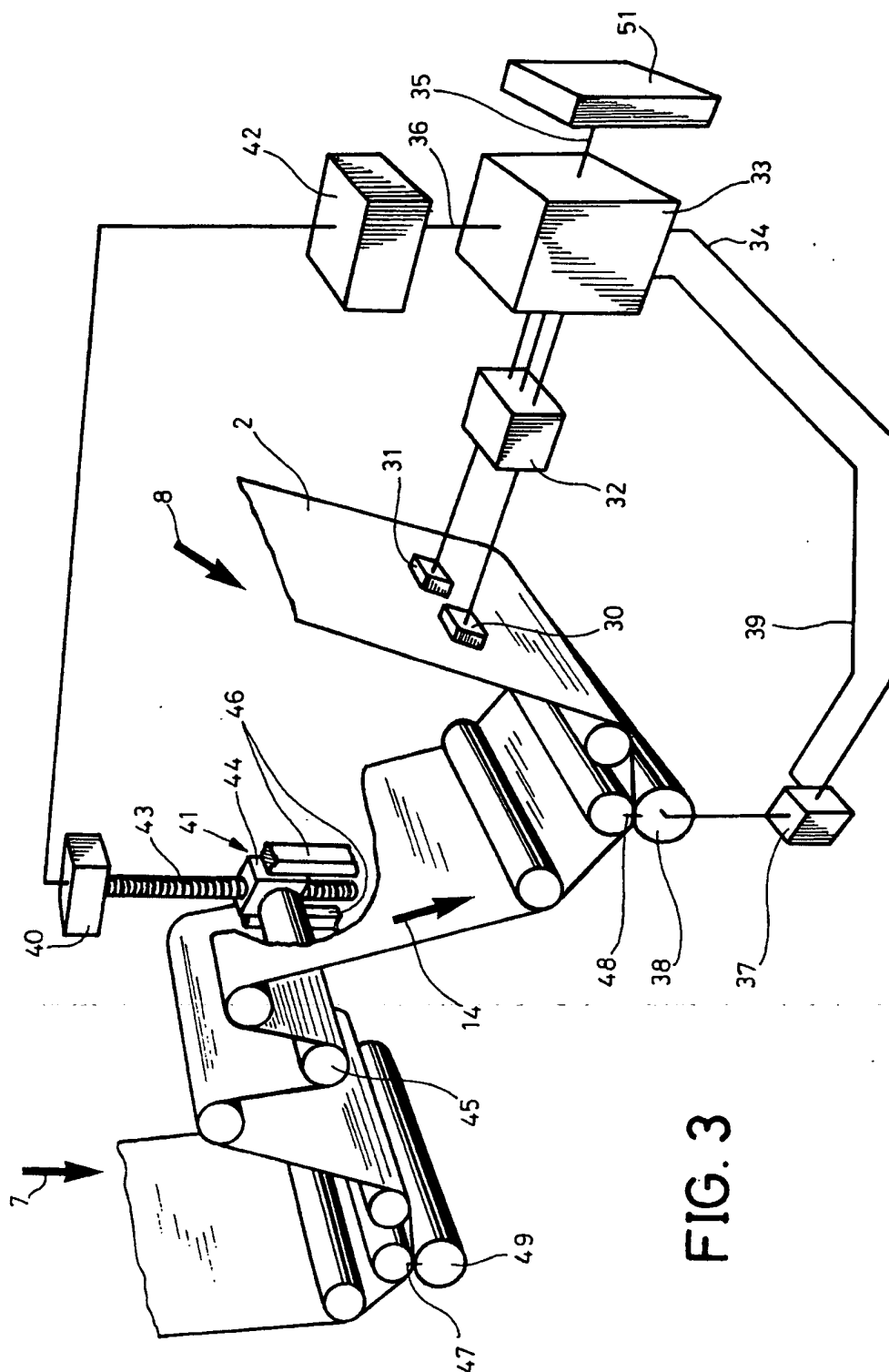


FIG. 4

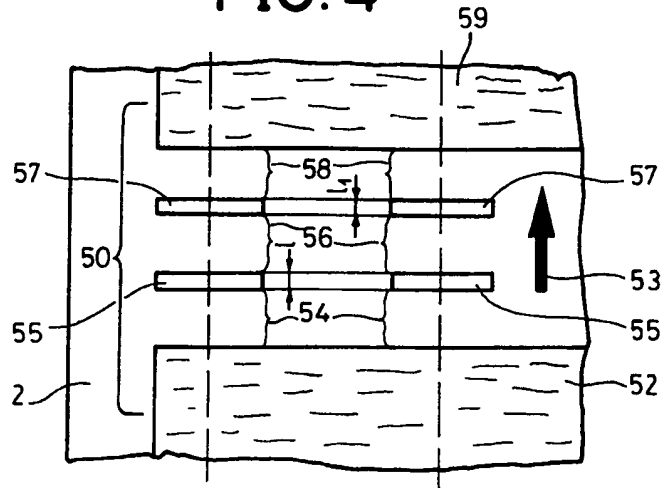
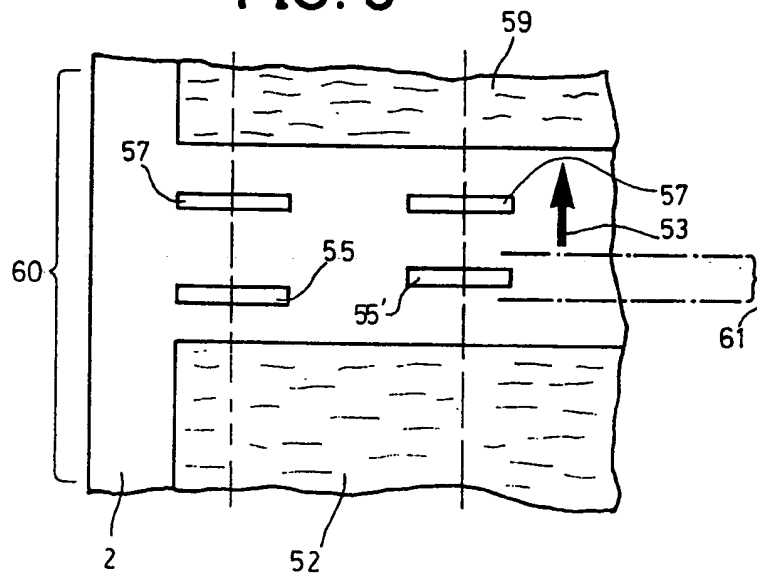


FIG. 5



SPECIFICATION

Method and device identifying registering marks in order to position a reading aperture

5 The present invention relates to a method and a device for identifying registration marks, in order to position a reading aperture in a machine processing web material.

Continuously moving web material can receive, for instance, the print of a coloured picture in a printing machine. The processing takes place in successive printing units. The superimpositioning of the picture printed by the successive printing units finally produces the well known coloured pictures, used, for instance, for coloured prospectuses, posters or calendars. The production of satisfactory results depends on the accuracy of the register control in each printing unit, i.e. the different pictures must be properly superimposed relative to the other. To that end, each printing plate of a printing cylinder bears one or several registration marks. These marks are transferred subsequently on the material to be printed with the colour corresponding to the printing unit where the printing plate was inked. Then, all the registration marks printed in the various printing units simply have to be properly superimposed, to make sure that the superimposition of the various pictures is correct.

Registration requires a first operation, i.e. the detection of the marks on the printed paper, and a second operation, i.e. the correction of any registration error. Consequently, the correction of the registering error is related to the detection of the registering mark. Known devices for the detection of registering marks generally use reading heads in order to look at the moving printed web. These reading heads operate during a period determined usually by electric or magnetic cam systems, acting as phase selectors.

40 In order to set such devices, the operator has to stop the printing machine as soon as the registration marks are properly positioned relative to the reading heads. Then he positions the electric cam, so that it produces for each revolution of the cylinder two different signals indicating the start and the end of a reading aperture confining the registration mark. Swiss Patent Specification No. 548 933 describes such equipment.

50 A second device, similar to the one described, works as follows. In the standstill or slow running mode, the operator visually detects the registration marks, as soon as the registration marks are properly positioned, he starts electronic units which memorize the position of the registration marks. Then the printing press is started again, in its normal running mode. At each revolution of the printing cylinder, the memory recalls the position of the registration mark thereby allowing its detection by the reading head.

A third arrangement comprises a device mounted on reading heads which detect the transversal length of the registration mark, with the help of several photodiodes located lengthwise

65 on a line along the registration marks. The photodiodes at each end of a row are located in such a way that they do not detect a mark, but a space. Thus, if the photodiodes in the centre of the mark read an imprint when, simultaneously, the photodiodes at the end of the row read a space, they are detecting a registering mark. This happens when the photodiodes detect a space just before and just after the registration mark. This detection of spaces before and after a registration mark, can hence be considered as an identification of a registration mark. These conditions being assured, the location of the mark is memorised and a reading aperture is created at this place, at each revolution of the printing cylinder. The registration mark reading head is thus operated each time this aperture appears. The system allows the detection of a registration mark, while the printing press is running. Such a device is described in French Patent Specification No. 1 470 054.

The above-mentioned devices unfortunately have several drawbacks. The first one requires the standstill of the press during the adjustment and hence loss of time. Also there is the danger of sticking of the web against the printing cylinder, and this might break the web when the machine starts running again, which would cause another loss of production.

The second device has the drawback of depending on the speed of reaction of the operator, who has to action, when necessary, the unit which memorizes the registration mark. If the standstill mode is chosen, there is the disadvantage already described for the previous device.

100 The third device eliminates the drawbacks of the two first, but uses in combination a normal reading head and a special device with additional photodiodes. Thus the device is more complicated and expensive. Moreover, the device can detect an imprint related to a registration mark, but it cannot tell which printing unit made this mark.

The present invention provides a device for detecting registration marks for the positioning of a reading aperture, which is simple and able to eliminate the disadvantages of the above-mentioned devices.

According to one aspect of the present invention there is provided a method for identifying registration marks on a web of material comprises examining the surface of the web after it has passed over an engraved cylinder, sensing the angular position of the engraved cylinder, storing information relating to said angular position, analysing information obtained from said examination of said surface, and adjusting the path length of the web between two points to permit identification of registration marks by comparison of information from successive examinations of said surface.

According to another aspect of the present invention there is provided a device for identifying registration marks on a web of material comprises means for examining the surface of the web after it

has passed over an engraved cylinder, means for analysing information resulting from said examination, means for sensing the angular

- position of said cylinder, means for storing information indicative of the sensed angular position of the cylinder, and means operable in response to signals received from said analysing means for adjusting the path length of the web between two given points wherein identification of registration marks can be carried out by comparison of successive examination of said surface.
- The invention will be described now by way of example only with particular reference to the accompanying drawings. In the drawings:
- Figure 1 is a schematic view of a multicolour printing press;
- Figures 2a, 2b, 2c show examples of imprint readings;
- Figure 3 is a schematic view of a device for identifying registering marks, and
- Figures 4 and 5 show the evolution of the pictures read during the registering mark identification.
- Figure 1 is a schematic view of a multicolour printing press which in the present case is a four colour printing press. The printing press 1 is designed to process a web 2 of paper or cardboard delivered from a reel 3 which is supported on a reel stand 4. The web 2 is fed into a printing unit 5 by an infeed unit 6; assume that the first printing unit 5 prints the colour yellow; the web 2 then runs through the printing units 7, 8 and 9 which print respectively the red, the blue and finally the black. The web 2 is then rewound onto a reel or cut into sheets, or processed in any other way, for instance cut into blanks.
- Each printing unit is combined with a dryer 13, to avoid any staining of the web 2 during rewinding or processing. The rewinding of the web 2 occurs on a reel 10 supported on a reel stand 11.
- In order to correct any registration error, between the respective colour of each printing unit, each of them is equipped with an idler roller 12 driven by a unit which checks the registration (not shown) and is mounted in the printing press.
- Figures 2a, 2b, 2c show imprint reading examples. Figure 2a shows the cardboard or paper web to be printed. The web moves in the direction shown by the arrow 14 and the reading heads (not shown) are located along the paths 15 and 16 shown in dotted lines. The imprint of the picture on the web is illustrated by the areas 17 and 18.
- The rectangle 19 represents a registration mark. Figure 2b shows the web 2 on which flat prints 20 and 21, and two strips 22 and 23 are printed. These two strips 22 and 23 are shown laying between the flat prints 20 and 21 and, as these flat prints and the two strips 22 and 23 are separated by spaces, they could be considered as registration marks by the reading heads located along the path 15 and 16.
- Figure 2c also shows the web 2 bearing imprints 24 and 25 separated by marks 26, 27, 28

and 29. The marks are located between imprints 24 and 25 and are not necessarily all registration marks to be used by the same printing unit, i.e.

- unit 8. In the chosen example, only mark 29 is the registration mark for the printing unit 8. It can be identified as such by means of the present device. The mark determines the reading aperture 61. The identification of the registration marks relies on the examination of the web 2 moving in the direction of arrows 14 to determine the areas where such registration marks can appear. To that end, two reading heads 30 and 31 (see Figure 3) connected to an amplifier 32 are used. The output signal from the amplifier 32 is fed to an analyzing device 33 which generates three output signals on lines 34, 35 and 36. The signal 34 controls an angular encoder 37 which is connected to an engraved cylinder 38 to detect its angular position, when the reading heads 30 and 31 detect that a possible registration mark area exists. The angular encoder 37 emits a detection signal on line 39 which is transmitted to the analyzing device 33. The device 33 responds by producing a control signal on line 36 which is transmitted by the command circuit 42 to the motor 40 of an idler roller 41. The motor 40 can produce rotation in either direction and is coupled to a screw 43 which acts on a bearing 44 supporting the roll 45 of the idler roller 41. When it shifts, the movement of bearing 44 is guided by slots 46. In order to simplify the drawing, only the slots 46 on the left side, relative to the shifting direction of the web 2 in the processing machine are shown. It will be appreciated that the other end of the roll 45 is also supported by a bearing into which a screw identical to the other screw 43 engages. These two screws are coupled to each other by a connection (not shown) which comprises, for instance, sprocket wheels and a chain allowing the same rotation of both screws. The idler roller 41 when shifted vertically in one direction or the other produces a change in the length of the path of the web between the two points 47 and 48. Thus, the registration mark printed by the engraved cylinder 38 is shifted relative to the marks on the web which have been printed previously, for instance by the engraved cylinder 49 or by an engraved cylinder of any other of the printing units. The reading heads 30 and 31, sensing the existence of registration marks in a given area, simultaneously indicate the presence of such marks to the analyzing device 33. The device 33 receives signals from the reading heads 30 and 31 and process the signals to check the position of the various marks relative to each other. If the operation shows that one of the marks is shifted relative to the other, the internal circuits of the analyzing device 33 emit a signal 35 derived from the detection signal 39 which is transmitted to the memory 51; the detection signal 39 representing the angular position of the area for the detection of registration marks having been memorized, the angular encoder 37 transmits at each complete revolution of the engraved cylinder 38, the detection signal 39 to the analyzing device

33, which, by means of another internal circuit controls the operation of a registration mark reading head connected with a device for the adjustment of the registration error (not shown). If no misadjustment of the mark appears when the analyzing device 33 processes the signals supplied by the reading heads 30 and 31, the internal circuits of the analyzing device 33 do not send out any memory signal 35, so that the detection signal 39 detecting the angular position of the marks detection area is not registered. The analyzing device 33 also includes a circuit allowing determination on the basis of the known registration mark position, as to which engraved cylinder it belongs. It also includes another circuit which creates a reading aperture 61 around the known registration mark.

Figure 4 shows the imprints of the web 2 in an area 50 corresponding to a possible registration mark detection area. The area 50 presents the condition requested for the existence of registering marks, i.e. the presence of a printed area 52 followed in the direction shown by arrow 53 by a first space 54, then by a first printed area 55, the width l of which could suggest a registration mark, then by a second space 56, a second printed area 57, with a width l_1 also suggesting a registration mark, a third space 58 and by another printed area 59. The reading heads 30 and 31 (see Figure 3) having transmitted signals representing this information to the analyzing device 33, the device controls the shifting of the idler roller 41. If the reading heads 30 and 31 detect, at their next reading operation, the same pattern of various imprints, the analyzing device 33 does not send out any memory signal 35, which means that the first and second imprints 55 and 57 are not registration marks.

Figure 5 also shows imprints in an area 60 suggesting the eventuality of a registration mark detection area. On its passage in front of the reading heads 30 and 31, the pattern of this area 60 appears identical to the one of area 50 illustrated in Figure 4. But after the shifting of the idler roller commanded by the analyzing device 33, one of the marks 55 is still shown in its position 55', while the other marks 55 and 57 are shifted. Consequently, the information delivered by the reading heads 30 and 31 to the analyzing device 33 is different from the previously delivered one. Thus, the analyzing device sends out a memory signal 35, so that the reading aperture 61 has to be determined and memorised in order to be automatically recalled at each revolution of the engraved cylinder 38 (see Figure 3).

CLAIMS

1. A method for identifying registration marks on a web of material comprises examining the surface of the web after it has passed over an engraved cylinder, sensing the angular position of the engraved cylinder, storing information relating to said angular position, analysing information obtained from said examination of said surface, and adjusting the path length of the web between

65 two points to permit identification of registration marks by comparison of information from successive examinations of said surface.

2. A method for identifying registration marks in order to position a reading aperture in a machine which processes web-like material, characterised by the fact that imprints on the moving web are read after the web has passed over an engraved cylinder in a printing unit, the information obtained is analyzed, the printed and unprinted areas on the web determine at least one area bearing registration marks, a "plus or minus" elongation of the web is created and in the case of a "plus" elongation of the web, the relative position of the marks on the web in said area bearing registration marks is checked, the angular position of the engraved cylinder having printed said marks is memorised to create a reading aperture, if there is a displacement between the various marks, and subsequently the memorised angular position of the engraved cylinder is reset at each revolution of the cylinder.

3. A method according to claim 2 wherein a "plus or minus" elongation of the web is created between two points on said web, and that the area bearing registration marks is determined with regard to a first printed area, followed by a first printless area, a second printed area, a second printless area, a third printed area, a third printless area and a fourth printed area.

4. A device for identifying registration marks on a web of material comprises means for examining the surface of the web after it has passed over an engraved cylinder, means for analyzing information resulting from said examination, means for sensing the angular position of said cylinder, means for storing information indicative of the sensed angular position of the cylinder, and means operable in response to signals received from said analyzing means for adjusting the path length of the web between two given points whereby identification of registration marks can be carried out by comparison of successive examinations of said surface.

5. A device for identifying registration marks on a web of material comprising means for examining the surface of the web, means for analyzing the information resulting from said examination of the web, means for detecting the angular position of an engraved cylinder over which the web passes, means for storing information indicative of the angular position of said engraved cylinder and means operable in response to signals from said analyzing means for creating a "plus or minus" elongation of the web.

6. A device according to claim 5 wherein the examining means includes two reading heads and the device includes means for amplifying the reading head output signals.

7. A device according to claim 6 wherein said analysing means includes an analyzing device having circuits for processing the information received from the reading heads, circuits for controlling the storing of information relating to the angular position of the engraved cylinder, and

circuits for producing a control signal for controlling the elongation creation means.

5 8. A device according to claim 5 wherein the means for detecting the angular position of the engraved cylinder comprises an angular encoder coupled to the analyzing means and the means for storing information relating to the angular position of the engraved cylinder comprise a memory connected to the analyzing device.

10 9. A device according to claim 5 wherein the elongation creation means comprises an idler

roller drivable by a motor and a circuit responsive to said control signal produced by the analyzing means for actuating the motor.

15 10. A method for identifying registration marks on a web of material substantially as hereinbefore described.

20 11. A device for identifying registration marks on a web of material substantially as hereinbefore described with reference to and as shown in the accompanying drawings.